Exploring Mothers' Perspectives on Socially Assistive Robots in Peripartum Depression Screening

Tobiaz Paulsson
Department of Information Technology
Uppsala University
Uppsala, Sweden
tobiaz.paulsson.2376@student.uu.se

Mengyu Zhong
Department of Information Technology and Women's Mental Health during the Reproductive Lifespan – Womher
Uppsala University
Uppsala, Sweden
mengyu.zhong@it.uu.se

Isabel García Velázquez
Department of Thematic Studies (TEMA)
Linköping University
Linköping, Sweden
isabel.garcia.velazquez@liu.se

Ginevra Castellano
Department of Information Technology
Uppsala University
Uppsala, Sweden
ginevra.castellano@it.uu.se

ABSTRACT

Peripartum Depression (PPD) affects 8-15 percent of new mothers in Sweden every year; a majority of PPD cases go undetected, and only a small percentage receives adequate care. Social Assistive Robots (SARs) bring great potential for healthcare applications. Using SARs in healthcare tasks, for example PPD Screening, could reduce healthcare professionals' strain, by supporting them, without replacing them, in key roles. However, studies that investigate the possibility to utilize SARs in PPD screening are scarce. In this paper, we present an interview study with ten mothers with prior experience of PPD in relation to their pregnancy. The contributions from this work are twofold. First, we elicited participants' opinions and attitudes towards utilizing SARs in PPD screening. Second, we explored participants' expressed needs in PPD screening. From the participants' statements, we discovered potential scenarios which could address future patients' needs. These insights could be used as a foundation for the development of SARs in PPD screening and other mental healthcare applications, thus helping address PPD in women.

CCS CONCEPTS

• **Human-centered computing**;

KEYWORDS

Peripartum Depression, HRI Design, Socially Assistive Robots

1 INTRODUCTION

To become a parent may be connected to feelings of joy and hope for the future. About 120,000 children are born in Sweden each year [6] and new parents are expected to embrace this time in their life with happiness. However, Peripartum Depression (PPD) affects 8-15 percent of new mothers in Sweden every year [4], which has a significant impact on their lives. A person with PPD might experience anxiety, sadness, and loss of joy of life [8]. It may also cause sleep issues, loss of appetite or inability to perform everyday activities. This extra burden can influence parents' ability to take care of the newborn. A decrease in quality of care can have negative effects on a child's growth and development, which could lead to delayed milestones and child neglect [5].

It is likely that women do not seek professional help when experiencing symptoms of PPD, as they may believe that expressing their negative emotions might not make them a "good enough" parent or that the emotions could be related to the stress of being a new parent [8]. A recent review [2] suggests that close to 69 percent of PPD cases are undetected and only 6 percent receive adequate treatment for their symptoms. Thus, investigating new ways to screen and diagnose women with PPD is needed.

Socially Assistive Robots (SARs) can potentially benefit both patients and healthcare professionals in the context of PPD Screening. However, related studies are rather sparse. In two recent interview studies, psychiatrists/PPD experts expressed that SARs could be useful in assisting with simple tasks for PPD screening, as a way to reduce workload [7, 9], which manifests the desired investigation of direct robot users' perspectives towards using SARs in PPD screening. Moreover, there are no previous studies involving mothers' perspectives on SARs in PPD Screening. Involving these stakeholders is essential, and will likely lead to suitable and accurate outcomes. Utilizing User-Centred Design (UCD) activities is a good starting point to derive design recommendations for further development of SARs in this context.

This paper conducts an initial exploration, via an interview study, of the expressed needs in PPD healthcare, as well as perspectives,

opinions and attitudes towards SARs in PPD Screening from mothers with prior experience of PPD. This study offers two main contributions. The first contribution focuses on participants' sentiments towards SARs in PPD Screening. This was achieved by using video examples of a Furhat robot interacting with a fictional patient in a healthcare scenario (Figure 1). Second, we explored participants' expressed needs in PPD healthcare. This provided perspectives on how participants perceived that SARs could be utilized in PPD Screening scenarios to address patients' needs. We discovered use cases that could bridge healthcare instances, letting SARs be a continuous point of contact for the mother, which focus on her mental health throughout the pregnancy.
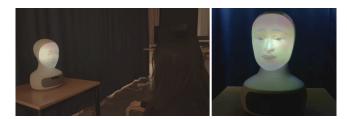

Figure 1: Furhat robot interacting with the actress (Left). Close up video screenshot of the Furhat robot (Right).

2 METHODOLOGY

We aim to address three main research questions:

- Q1: What are the sentiments of new mothers towards using SARs in PPD Screening?
- Q2: Which PPD mental healthcare needs do participants express?
- Q3: How could SARs address expressed healthcare needs?

2.1 Participants

Ten mothers with experience of PPD located in Sweden were included in the study. We aimed to recruit participants that are currently healthy. The screening tool Edinburgh Postnatal Depression Scale (EPDS) is developed to identify women with possible symptoms of PPD [3]. EPDS is a ten item questionnaire that contains questions regarding various clinical depression symptoms.

Participants were recruited from three sources. The first source was mailing lists from a research project focusing on predicting PPD with mobile app data, Mom2b (n=6). The inclusion criteria were women with at least one occurrence of an EPDS score above 12 in the past and a recent EPDS score of 10 or lower. Having an EPDS score of 12 or above indicates moderate probability of depression, while a score of 10 or lower suggests low likelihood of depression symptoms. The second source was the volunteer organization Mamma-till-Mamma (n=3), which aims to prevent mental illness in relation to pregnancy. They also provide counselling to new parents who may experience mental health issues, and advertised the study on their social media channels. The last source was a closed support group on Facebook for women with PPD experience (n=1). All participants ensured during the recruitment, and prior to the procedure, that they were not currently treated for or diagnosed with PPD or other mental illnesses. The mean age

of participants was 34.7±4.03. Participants were asked about their experience with digital technology (i.e., computers, smartphones etc.) and experience with social robots on a five point Likert scale between 1-5, where one equalled "no experience", and five equalled "very experienced". The mean score for technology experience was 4.3, and experience with social robots was 1.4. This indicated that the participants were proficient with technology, but had low or no experience interacting with social robots. Participants were encouraged to use a device with a large screen (i.e., computer or tablet) during the interview, as images and video would be presented to them during the procedure. All participants received a 200 SEK gift card as compensation for participating in the study.

The study is approved by the local ethical committee. Participants received information about the study and how their data is handled before giving consent. Participants were informed that they could withdraw from the study at any time.

2.2 Procedure

Semi-structured interviews were conducted over Zoom, following an interview protocol in Swedish. A pilot study was conducted prior to the interviews to trial and adjust the procedure. The goals with the interview were to: (1) develop a greater understanding of the problem context for PPD Screening, and (2) elicit participants' perceptions, attitudes, opinions and possible use cases regarding SARs for PPD Screening.

In the first part of the interview, participants were asked about their experiences with maternal-child health services in relation to their pregnancy and mental health. This included questions relating to the participants' mental health during and after pregnancy, the healthcare professionals' role in giving advocate care and support, how participants perceived the EPDS screening and what challenges there are to discover and diagnose mothers with PPD. Prior to the second part of the interview, focused on SARs and PPD screening, the participants got a short presentation (5–10 minutes) containing a brief introduction to the concept of social robots, with some example of applications, scenarios and capabilities.

Then, the participants were asked to read a text vignette of a fictional scenario, similarly to [7]. The text presented a fictional character who was about to become a mother, but encountered difficulties talking about her mental health due to the social stigma and the lack of time given from maternal health services. The fictional character was asked by healthcare personnel if she wanted to talk about her mental health with a social robot. The vignette continues to describe the character's interaction with the robot and ends with the character receiving insight into her mental health and the healthcare professional's ability to take part in the conversation. Lastly, the participant was presented with a video demonstration showing a Furhat robot interacting with an actress, similar to the fictional scenario described in the vignette. Screenshots of the video can be seen in Figure 1.

After viewing the video demonstration, the participants were asked questions regarding their opinions of the fictional scenario and video demonstration. These questions included perspectives of the possibility to screen mothers for PPD with SARs, what they thought of using SARs in maternal-child health services, and what they would need to be comfortable to interact with SARs in this

setting. Questions regarding privacy, data collection and trust were also discussed.

2.3 Analysis

Interviews' audio recordings were transcribed using a semi-automatic service and later validated by the first author for accuracy. The data were analysed using thematic analysis. The analysis followed Braun & Clarke's six phases of Thematic analysis [1] which are: (1) Familiarization with the data, (2) Generating initial codes, (3) Searching for themes, (4) Reviewing themes, (5) Defining and naming themes, (6) Producing the report.

3 RESULTS

From the Thematic analysis, 427 annotations were made, of which 30 annotations were discarded for irrelevancy or lack of clarity. In the first theme review, seven themes emerged, with 18 subthemes from 46 codes. These were visualized as a thematic map. In the second level refinement of themes, the dataset was overhauled for coherency, upon which subthemes were reorganized and/or merged. From this, two themes surfaced, with six subthemes. In this section, themes and subthemes will be used as means to structure the results.

3.1 Sentiments towards SARs in PPD Mental Healthcare

3.1.1 Opinion towards SARs for PPD Screening. Participants had mixed opinions on using SARs for PPD Screening. Among the positive sentiments, participants perceived the robot in the video as intelligent and capable to interact with the fictional patient. Some participants thought that the human likeness in the robot's behaviour contributed to a positive experience. Having congruence in the robot's behaviour and the tone of voice could make it easier to *"just follow along with the interaction"*, as one participant describes it. However, a few participants thought the robot was too enthusiastic in the presented context; a participant expressed that it would have made her uncomfortable if the robot would be too peppy.

Five participants expressed that they would have accepted to talk to a similar robot as shown in the video. Some participants thought it would be beneficial to interact with a robot instead of a human, as they would not feel a time pressure to take up healthcare resources. Eight participants expressed that they felt a lack of time when meeting healthcare professionals. Among participants' comments, they expressed that the healthcare professionals did not always have leeway for anything else but their healthcare routine before meeting the next patient. This could make the mother feel that she did not want to raise awareness to her symptoms, therefore holding back her feelings. A majority of the opinions on how the robot should be used, stated that it should not replace healthcare professionals, but be used as a compliment to human-to-human healthcare. Four participants felt that they might be comfortable talking to the robot, however, the non-human element would later make them feel discarded or abandoned by the healthcare system. P4 describes: *"I think I could have felt comfortable after a while talking to this robot. But that in retrospect I would probably have felt, 'Well, so no one had time for me?'".*

Seven participants mentioned that letting patients try out interacting with the robot could help determine if it would be useful for them. Having a first casual interaction with the robot could help the mother to gain insights in what it is like talking to a robot. Moreover, it could also make users discover the robot's social capabilities, and how well it can understand the interaction with humans. This may ultimately lead to trust building before using the robot for healthcare applications. A few participants mentioned, however, that one misinterpretation by the robot could lead to a bad experience. Having a bad user experience could rapidly diminish trust built between the robot and the patient.

3.1.2 Utilizing SARs for PPD Screening. Five participants expressed that the robot could be a useful screening tool for PPD, in comparison to the EPDS questionnaire. Having questions asked verbally instead of reading them in a self-assessment form, could allow the mother to be reflective upon her answer, instead of focusing on what numbers are on the line below the question, as one participant stated. Moreover, participants thought the robot would be useful to detect nuances in the mother's response, which a questionnaire would not. Some participants also thought the robot could ask relevant follow-up questions to responses, making the answers more elaborate for the healthcare professional's validation. Two participants expressed that they would feel comfortable opening up about their feelings to a robot. P1 describes: *"when it comes to screening, like how you feel and so on, I would feel a little more liberated because it's a robot in front of me, like a little more relaxed".* Some participants thought it would be easier to talk to something that would not be human, as it could be more objective towards the content of the interaction than a human would.

Four participants were uncertain about whether the robot would be able to interpret the situation as well as a human. Two main concerns were raised: (1) How the robot would interpret the spoken language, both semantically and the underlying meaning of the conversation. (2) How the robot would interpret non-verbal cues. P10 describes: *"I don't know how it can understand the subtle feelings and meaning of what people say. I don't know if I fully trust it to be able to read between the lines like a human could".* A few participants were doubtful whether the robot would detect feelings that the mother implicitly expresses. To judge by the video demonstration, two participants had trouble with the robot being "too human".

3.2 Expressed Mental Healthcare Needs

3.2.1 Informing about PPD. Eight participants expressed that they would have liked to have more information about PPD, as it may manifest during or after their pregnancy. The information should come directly from maternal-child health services, preferably in a meeting, talking about it to raise awareness and making mothers mindful of the symptoms. Two participants emphasized the importance of informing mothers directly by conversation, as written information may be overlooked or may not be relevant for the mother's current situation. Also, there is no possibility to ask questions on the subject. Multiple participants expressed that early information about PPD is important to make mothers aware of PPD symptoms. This could, of course, vary from mother to mother.

Informing about PPD could go beyond the mother, and also include the partner. All participants were positive towards including their partner in PPD mental healthcare, with or without SARs. The majority of participants expressed that their partners are often left

out. Partners are typically the ones who are closest to the mother and therefore could notice if changes in their mood or behaviour occur. P5 describes: *"He [The partner] may not need treatment, but it may be good to include him if you want to discover peripartum depression in women. He's the one who will see her most of the time".* Including partners could also help to sympathize with the woman's experience of pregnancy, according to a few participants.

3.2.2 Early aid. Seven participants expressed that they wished to get help with their mental health at an earlier stage in healthcare. Although a mother's mood may fluctuate during and after pregnancy due to changes in her body, multiple participants expressed that long term feelings of sadness were either minimized or discarded by maternity child health services, as it is common to experience these feelings in relation to pregnancy. P10 describes: *"They [child service nurse] shrugged and said that it was hormones and that it would pass. And then the discussion was over. Even though I specifically said that I thought I had depression. They said that it would be followed up at the ten-week check-up. Then another ten weeks passed where I felt very bad".*

A majority of participants were positive to include a robot early in their pregnancy. Nine participants stated that there is a void when mothers were transferred between maternity care services and child health services. In Sweden, the woman visits the maternity care service until childbirth and once or twice after labour. Then, child health services continue to provide healthcare to both the child and mother. The majority of the concerns were regarding the lack of coordination between instances, changing from midwife to child health nurse may cause patients to receive inadequate attention concerning their mental health. P3 describes: *"What I don't like about the Swedish healthcare system is that when you have given birth to the child, then the maternity health services let go of you all the way, as well as the history and the dialogue, and then the child health services take over. Then you can end up with anyone".*

3.2.3 Expressing thoughts. Having a mother talking out loud and expressing her feelings with a robot could raise awareness to reflect upon her mental health. Four participants stated that the robot could be useful to have participants vent their thoughts without being judged by another human being. Having the robot to counsel the patient by asking directed questions could be good as a beginning to recognize and admit her feelings. P7 states: *"It helps to say things out loud sometimes. So that it could be… 'Do you want to have a private meeting with this robot? It's not something we record, it's not something we film, it's just for your sake.' And then afterwards, maybe directly afterwards or some time in between, meet with health professionals and talk about it. Then you could feel that, you want to talk about what you actually dared to say to the robot".* There are, however, times that healthcare should intervene. If thoughts relating to self harm or suicide occur, then healthcare professionals should be notified. The opinions on what data the robot should record and store is mixed among participants. Informing patients what is being recorded, how it is stored and shared would be good, as it shows transparency towards the technology. Two participants would have wished to review the information before it is sent to healthcare professionals. Some participants state that it defeats the purpose of having unsupervised conversations with a robot if its recorded audio would be sent to someone to listen to later. One

alternative, suggested by P5, would be to let the patient choose if they want the data to be sent or not before the interaction with the robot begins. However, once again there should be balance between privacy and providing adequate care; *"…at the same time, are you opening yourself up completely if you know someone [healthcare professional] will listen?"* (P5).

3.2.4 Focus on mental health. In relation to the mother's pregnancy, eight participants expressed that there was a lack of focus on their mental health. They perceived that the focus was mainly on the child's development and physical health. Questions regarding the mother's mental health were rarely discussed, if it was not brought up by the mother. Five participants expressed that they did not know where to seek help for their depression symptoms. One occurring reason was that the participants perceived that maternity child health services focus their attention on the child development and the mother's physical health, but are not as responsive to the mother's mental health. Multiple participants sensed that it is difficult to talk about their mental health at the maternal-child health services.

Attention towards the mother's mental health is only one part of discovering PPD. Participants also mentioned various reasons why they did not want to talk about how they felt during or after their pregnancy. One common reason was feelings of shame, to be judged as a bad mother or woman. P6 describes: *"I really loved my child, but I was so ashamed that I couldn't take care of myself and him. […] There is no instruction book on how to deal with all your feelings, thoughts of loneliness and guilt… And there is a lot of shame related to it".*

4 CONCLUSION

This paper explored perspectives from mothers with prior experience of PPD on needs in relation to pregnancy and mental healthcare and on the use of SARs in PPD screening. Participants had mixed opinions towards the use of SARs for PPD screening, with raised concerns regarding the robot's ability to analyse the interactions with a patient, and replace human-to-human healthcare practice. However, one half of the participants would consider using it in healthcare applications, if themselves could choose to interact with the robot as a complementary part of the healthcare package. We also discovered potential scenarios involving SARs which could help address patients' needs that are currently not met by the healthcare system. These results highlight both the potential for further investigation on the ethical use of SARs in PPD screening, and the need to conduct a design process of SARs that is truly user-centred.

Further research is needed to gain additional insights from women with PPD, but also their partners, and to investigate how to address the expressed healthcare needs. Lastly, perspectives from healthcare professionals, especially midwives and child health nurses, would also be very valuable to explore how SARs could be useful in healthcare settings.

5 ACKNOWLEDGMENTS

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